भारतीय मानक
IS 11520 : 2023

Indian Standard

कठोर धातुओं का मेटालोग्राफिक नमूना तैयार करना — पद्धति

(पहला पुनरीक्षण)

Metallographic Sample Preparation of Hardmetals — Method

(First Revision)

ICS 77.160

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Powder Metallurgical Materials and Products Sectional Committee, MTD 25

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Powder Metallurgical Materials and Products Sectional Committee had been approved by the Metallurgical Engineering Division Council.

This standard was first published in 1985. This revision has been brought out to bring the standard in the latest style and format of the Indian Standards.

In addition, the following changes have been made:

a) Clause **3.1.2** on rough grinding has been modified; and
b) Basic safety requirements to be observed during metallography have been included.

With the increasing use of hardmetals, a need has been felt for having standards on the metallographic examination. It is hoped that the revision of this standard will be of considerable use to the industry.

The composition of the Committee responsible for the formulation of this standard is given in Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 ‘Rules for rounding off numerical values (*second revision*)’. The number of significant places retained in the rounded off value should be same as that of the specified value in this standard

Indian Standard

METALLOGRAPHIC SAMPLE PREPARATION OF HARDMETALS — METHOD

(First Revision)

1 SCOPE

This standard prescribes a method for preparing hardmetal samples for metallographic examination.

2 SELECTION OF SPECIMEN

Hardmetals are very often in the form of relatively small pieces, it is possible to select and mount the entire piece in such a manner as to permit examination of the entire cross section. When pieces are too large for this, however, they should be sectioned, using a diamond cut off wheel, to allow viewing as much of a representative cross section as possible. For micrographic examination, the area selected should represent, as nearly as possible, the entire cross section.

3 PREPARATION OF SPECIMEN

There are several methods for preparing hardmetal surfaces for metallographic examination. Basically, they all employ diamond wheels for grinding and diamond paste or diamond powder for lapping. The grinding practices differ to a minor degree, with respect to the grit size of diamond. In all practices, however, the final polish is produced by extremely fine diamond powder or diamond paste lapping and in all practices care must be exercised to retain the microstructure in its true form and to avoid pull-out of the softer matrix material (usually cobalt).

3.1.1 *Mounting*

Where possible, specimen should be mounted in a plastic material such as phenol-formaldehyde or poly-methyl methacrylate to facilitate polishing without rounding the edges. Large specimens may be polished without mounting. When specimens are too large they may be sectioned using a diamond cut-off wheel or they may be fractured (appropriate safety precautions should be taken while breaking specimens). The area selected for examination should represent, as nearly as possible, the entire cross section.

3.1.2 *Rough Grinding*

The surface to be examined may be ground flat on a surface grinder with a resin-bonded diamond wheel (100 grit to 220 grit) operated at 25 m/s to 28 m/s. After the surface is flat, several clean-up passes are required. To ensure safe and efficient grinding, it is recommended to limit the depth of cut to a maximum of 13 µm per pass. It is important to use an ample amount of coolant during the cutting process. After grinding on each grit, the direction of specimen shall be changed perpendicular to the direction of grinding in the previous grit.

3.1.3 *Polishing*

Polishing is done in three steps using diamond powder or paste on a synthetic short-napped cloth (the reverse side of photographic paper). When automatic polishing equipment is used, a resin-bonded diamond disk may be substituted in the roughing lap. For manual polishing, speeds of 500 rpm to 600 rpm are used, automatic polishing generally requires speeds of 100 rpm to 200 rpm.

3.1.3.1 *Roughing lap*

This lap employs diamond powder of size 15 µm to 25 µm dispersed in light spindle oil or an equivalent diamond paste.

3.1.3.2 *Second lap*

This lap employs diamond powder of size 4 µm to 8 µm or an equivalent diamond paste.

3.1.3.3 *Finishing lap*

This lap employs diamond powder of size less than 2 µm or an equivalent diamond paste.

> NOTE — Best results are obtained by applying considerable pressure to the specimen in all lapping operations. Lack of adequate pressure will result in pulling but the softer matrix material (usually cobalt). It is also essential that the specimen and operator’s hands be thoroughly cleaned between all the grinding or polishing steps.

4 SAFETY PRECAUTIONS

Grinding machines are used daily at many workshops and laboratories. To avoid injuries, the following minimum safety precautions should be observed:

a) Wear goggles for all grinding machine operations;

b) Check grinding wheels for cracks before mounting;

c) Never operate grinding wheels at speeds in excess of the recommended speed;

d) Never adjust the workpiece or work mounting devices when the machine is operating;

e) Do not exceed recommended depth of cut for the grinding wheel or machine;

f) Remove workpiece from grinding wheel before turning machine off; and

g) Use proper wheel guards on all grinding machines.

ANNEX A

(*Foreword*)

COMMITTEE COMPOSITION

Powder Metallurgical Materials and Products Sectional Committee, MTD 25

Organization	*Representative(s)*
Indian Institute of Technology Kanpur, Kanpur	Dr Anish Upadhyay **(*Chairperson*)**
Bhabha Atomic Research Centre, Mumbai	Prof Amit Sinha
Bharat Heavy Electrical Limited, New Delhi	Shri Vivek Arya Shri Bharat Kumar Pant (*Alternate*)
Controllerate of Quality Assurance, Ichapur	Shri A. Mitra Shri T. K. Prusty (*Alternate*)
CSIR − Institute of Minerals & Materials Technology, Bhubaneswar	Dr Mayadhar Debata Dr Pradyut Sengupta (*Alternate*)
CSIR − National Metallurgical Laboratory, Jamshedpur	Dr V. C. Srivastava
Defence Institute of Quality Assurance, Bangalore	Dr N. Krishna Murthy
Defence Metallurgical Research Laboratory, Ministry of Defence, Hyderabad	Dr G. Appa Rao Shri N. Prabhu (*Alternate*)
Electronica Tungsten Limited, Malegaon	Shri A. N. Chaskar Shri Bhalchandra V. Pathak (*Alternate*)
Innomet Advanced Materials Private Limited, Hyderabad	Shri Vinay Chilakapati
Kennametal India Limited, Bengaluru	Shri Alok Bhaskar Shri K. Chandrashekar Shenoy (*Alternate* I) Shri Shashikumar S. (*Alternate* II)
Ministry of Defence, New Delhi	Shri A. K. Mukherjee
Mishra Dhatu Nigam Limited, Hyderabad	Shrimati U. Savitha Shri Badri Vishal Pandey (*Alternate*)
Nuclear Fuel Complex, Hyderabad	Shri Jobin Koshy Shri Nirmol Santra (*Alternate*)
Society of Indian Automobile Manufacturers (SIAM), Delhi	Shri P. K. Banerjee Shri Amit Kumar (*Alternate*)
The Metal Powder Company Limited, Madhurai	Shri P. Sundarapandian
BIS Directorate General	Shri Sanjiv Maini, Scientist ‘F’/Senior Director and Head (Metallurgical Engineering) [Representing Director General (*Ex-officio*)]

Member Secretary

Shri G. Ram Sai Kumar
Scientist ‘B’/Assistant Director
(Metallurgical Engineering), BIS

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